

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1 and 5-9 are currently pending. Claim 3 has been canceled without prejudice; and Claims 1 and 7 have been amended by the present amendment. The changes to the claims are supported by the originally filed specification and do not add new matter.

In the outstanding Office Action, Claims 1, 3, and 7-9 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Comanor et al. (“Algorithms to Identify Detector Computer Scattering in PET Modules”) (hereinafter “the Comanor et al. reference”) in view of U.S. Patent No. 4,857,737 to Kamae et al. (hereinafter “the ‘737 patent”); Claim 5 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Cho et al. (“Resolution and Sensitivity Improvement in Positron Emission Tomography by the First Interaction Point Determination”) (hereinafter the “Cho et al. reference”) in view of the ‘737 patent; and Claim 6 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the Comanor et al. reference and the ‘737 patent, further in view of U.S. Patent No. 5,793,045 to DiFilippo et al. (hereinafter “the ‘045 patent”).

Applicants respectfully submit that the rejection of Claim 3 is rendered moot by the present cancellation of that claim.

Amended Claim 1 is directed to a nuclear medicine diagnostic apparatus comprising:
(1) a radiation detector in the form of a single layer including a plurality of semiconductor cells that are arranged in a matrix, detect radiation separately, and output signals representing an energy of the radiation separately; (2) a selection circuit which, in order to select, among events wherein the radiation is detected, a specific event wherein radiation derived from a radio-isotope injected into a subject is detected and a total energy of not less than two respective signals substantially simultaneously output from not less than two semiconductor

cells falls in a predetermined energy window; (3) a position calculation circuit configured to select one semiconductor cell of the not less than two semiconductor cells based only on respective energies of the not less than two respective signals, and to calculate an incidence position based on a position of the selected one semiconductor cell; (4) a counting circuit configured to count the specific event in association with the calculated incidence position; and (5) a circuit configured to generate a distribution of radio-isotope in the subject on the basis of a counting result. Further, Claim 1 has been amended to incorporate the limitation recited in Claim 5, namely that the position calculation circuit is configured to select, from the not less than two semiconductor cells, the one semiconductor cell that outputs a signal representing a minimum energy, when the not less than two semiconductor cells are located in a first area, and to select the one semiconductor cell that outputs a signal representing a maximum energy, when the not less than two semiconductor cells are located in second area. Accordingly, the changes to Claim 1 are supported by the originally filed specification and do not add new matter.

Applicants respectfully submit that the rejection of Claim 1 is rendered moot by the present amendment to Claim 1. However, because Claim 1 has been amended to incorporate the limitations recited in Claim 5, Applicants address the references cited in the rejections of both Claim 1 and Claim 5.

The Comanor et al. reference is directed to an analysis of various algorithms to identify detector Compton scattering in hypothetical PET modules using Monte Carlo simulations. As shown in Section III of the Comanor et al. reference, various algorithms including the “maximum signal” algorithm, the “reject multiples” algorithm, the “second highest signal” algorithm, and the “joint” algorithm are discussed. However, Applicants respectfully submit that the Comanor et al. reference fails to disclose a position calculation circuit configured to select, from the not less than two semiconductor cells, the one

semiconductor cells that outputs a signal representing a minimum energy, when the not less than two semiconductor cells are located in a first area, and to select the one semiconductor cell that outputs a signal representing a maximum energy, when the not less than two semiconductor cells are located in a second area, as recited in amended Claim 1. In this regard, Applicants note that the Office Action has not relied on the Comanor et al. reference to disclose this limitation, which was recited in Claim 5.

The '737 patent is directed to a γ -ray detecting unit formed of a plurality of radiation detectors arranged in layers, as shown, for example, in Figures 1 and 2. Using energy and momentum conservation laws, the '737 detecting unit attempts to compute the reaction sequence and the scattering angle of multiple Compton scatterings within the detecting unit. As shown in Figure 2, the '737 patent discloses calculating an angle range of the incidence γ -ray (i.e., the conical surface C shown in Figure 2) at an initial incidence position (x_1, y_1, y_2) of the γ -ray based on subsequent incidence cell positions in the multiple-layer detecting unit and physical scattering laws. However, Applicants respectfully submit that the '737 patent fails to disclose a position calculation circuit configured to select, from the not less than two semiconductor cells, the one semiconductor cell that outputs a signal representing a minimum energy, when the not less than two semiconductor cells are located in a first area, and to select the one semiconductor cell that outputs a signal representing a maximum energy, when the not less than two semiconductor cells are located in a second area. In this regard, Applicants note that the Office Action does not rely on the '737 patent as disclosing this limitation recited in Claim 5.

The Cho et al. reference is directed to a new 2-D detector and associated detection algorithm to correct the effect of scattering and penetration to improve the resolution and sensitivity in Positron Emission Tomography. As discussed on page 1625, the Cho et al. reference discloses that in single Compton scattering, photon energy is deposited at two

different points in a 2-D crystal array. Further, the Cho et al. reference discloses that the determination of the first interaction point depends on whether there was forward-scattering by a small angle less than 60 degrees or by a large angle between 60 and 180 degrees. In the first case, the Cho et al. reference discloses that scattered photons retain more than two thirds of the incident photon energy and deposit less than 170 keV at the first interaction point. Moreover, the Cho et al. reference discloses that, in the second case, the photons are scattered through an angle larger than 60 degrees and absorbed at a second interaction point, wherein the deposited energy at each point lies between 170 keV and 340 keV. Further, the Cho et al. reference discloses that, in the first case, the smallest energy is selected as the first interaction point, while in the second case, various other selection rules, such as the “Mini-Max Energy Point Section Rules” and the “Geometrical Center or Centroid Selection Rules,” are applied.

However, Applicants respectfully submit that the Cho et al. reference fails to disclose a position calculation circuit configured to select, from the not less than two semiconductor cells, the one semiconductor cell that outputs a signal representing a minimum energy, when the not less than two semiconductor cells are located in a first area, and to select the one semiconductor cell that outputs a signal representing a maximum energy, when the not less than two semiconductor cells are located in a second area, as recited in amended Claim 1. First, Applicants note that the Cho et al. reference fails to disclose the two areas recited in Claim 5. Rather, the Cho et al. reference discloses two possible groups of potential scattering angles and recognizes that the energy deposited at the respective points in the array will be distributed differently in each case. However, Applicants respectfully submit that this is not a disclosure of two particular areas where cells are located, as recited in Claim 1. Moreover, Applicants note that while a smaller energy is selected for small angle scattering, the Cho et al. reference does not disclose that a maximum energy is selected in the second case, even if the first and second cases noted by the Cho et al. reference could be equated, arguendo, with.

the first and second areas recited in Claim 1. However, as discussed above, the first and second scattering angle groupings noted by the Cho et al. reference, which are detected based on the energy distribution, are unrelated to the first and second areas recited in Claim 1. Accordingly, for the reasons stated above, Applicants respectfully submit that the Cho et al. reference fails to disclose the position calculation circuit recited in amended Claim 1.

Thus, no matter how the teachings of the Comanor et al. reference, the '737 patent, and the Cho et al. reference are combined, the combination does not teach or suggest the position calculation circuit recited in amended Claim 1. Accordingly, Applicants respectfully submit that amended Claim 1 patentably defines over any proper combination of the Comanor et al. reference, the '737 patent, and the Cho et al. reference.

Independent Claim 5 recites limitations analogous to the limitations recited in amended Claim 1. Further, Claim 7 has been amended in a manner analogous to the amendment to Claim 1. In particular, Claim 7 has been amended to incorporate the above-discussed limitation recited in Claim 5. Accordingly, for the reasons stated above for the patentability of Claim 1, Applicants respectfully submit that independent Claims 5 and 7 (and all associated dependent claims) patentably define over any proper combination of the '737 patent, the Comanor et al. reference, and the Cho et al. reference.

Applicants respectfully submit that the rejection of Claim 6 is rendered moot by the present amendment to Claim 1. Applicants respectfully submit that the '054 patent fails to remedy the deficiencies of the Cho et al. reference, the Comanor et al. reference, and the '737 patent, as discussed above.

Thus, it is respectfully submitted that independent Claims 1, 5, and 7 (and all associated dependent claims) patentably define over any proper combination of the Comanor et al. reference, the Cho et al. reference, the '737 patent, and the '045 patent.

Consequently, in view of the present amendment and in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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